

CLAIMS

1. A semiconductor device having a semiconductor body (22) comprising an active area (7) and a termination structure (16) surrounding the active area, the termination structure comprising a plurality of lateral trench-gate transistor devices (2a to 2d) connected in series and extending from the active area towards a peripheral edge (42) of the semiconductor body, each lateral device comprising a trench (30) having a gate electrode (31) therein separated from the semiconductor body by a layer (32) of gate insulating material, the trenches, gate electrodes and layers of gate insulating material of the lateral devices being formed in the same respective process steps as trenches (20), insulated electrodes (11) therein and layers (25) of material insulating the insulated electrodes of devices in the active area, the gate electrodes (31) of the lateral devices extending through a region (15) of a first conductivity type, and part way through an underlying region (14a) of a second, opposite conductivity type, with each lateral device including an electrically conductive connection (8,23) between its gate electrode (31) and the first conductivity type region (15) at the side of the lateral device closer to the active area, such that a voltage difference between the active area and the peripheral edge is distributed across the lateral devices.

2. A semiconductor device of Claim 1 wherein the active area (7) comprises devices having a region (15) of the first conductivity type which is formed in the same process step as the first conductivity type region (15) of the lateral devices.

3. A semiconductor device of Claim 1 or Claim 2 wherein the insulated electrodes of the active area devices are gate electrodes (11) of trench-gate transistor devices, and the first conductivity type region of the active area devices forms a channel-accommodating region (15) thereof.

4. A semiconductor device of Claim 1 or Claim 2 wherein the insulated electrodes of the active area devices are trenched electrodes (60) of Schottky rectifiers.

5 5. A semiconductor device of any preceding Claim wherein the layer of insulating material (32) is thicker over the bottom of the trenches (30) of the lateral devices (2a to 2d) than over at least a portion of the sidewalls of said trenches.

10 6. A semiconductor device of any preceding Claim wherein the doping level of a respective portion (50) of the region (14a) of second conductivity type adjacent the bottom of each of the gate trenches (30) of the lateral devices is higher than that of the remainder of the second conductivity type region.

15 7. A semiconductor device of any preceding Claim wherein the semiconductor body (22) is rectangular in the plane of the body, and the connections (8,23) are provided towards one or more corners of the body.

20 8. A method of forming a semiconductor device having a semiconductor body (22) comprising an active area (7) and a termination structure (16) surrounding the active area, the termination structure comprising a plurality of lateral trench-gate transistor devices (2a to 2d) connected in series and extending from the active area towards a peripheral edge (42) of
25 the semiconductor body, each lateral device comprising a trench (30) having a gate electrode (31) therein separated from the semiconductor body by a layer of gate insulating material (32), the gate electrodes of the lateral devices extending through a region of a first conductivity type (15), and part way through an underlying region (14a) of a second, opposite conductivity type,
30 with each lateral device including an electrically conductive connection (8,23) between its gate electrode (31) and the first conductivity type region (15) at the side of the lateral device closer to the active area, such that a voltage

difference between the active area (7) and the peripheral edge (42) is distributed across the lateral devices, the method comprising forming the trenches (30), gate electrodes (31) and layers of gate insulating material (32) of the lateral devices in the same respective process steps as trenches (20),
5 insulated electrodes (11) therein and layers (25) of material insulating the insulated electrodes of devices in the active area (7).

9. A method of Claim 8 comprising forming a region (15) of the first conductivity type in devices of the active area (7) in the same process step as
10 the first conductivity type region (15) of the lateral devices.